

Gian Bruno Grippa (*) & Cédric d'Udekem d'Acoz (**)

The genus *Periclimenes* Costa, 1844
in the Mediterranean Sea and the Northeastern
Atlantic Ocean: review of the species and description
of *Periclimenes sagittifer aegylios* subsp. nov.
(Crustacea, Decapoda, Caridea, Pontoniinae)

Abstract – The shrimps of the genus *Periclimenes* in the Northeastern Atlantic and the Mediterranean present a complex and little known systematic. In the present paper, several problems are solved, a new subspecies is described and a new identification key is proposed. Furthermore the systematic value of live colour patterns in the taxa examined is briefly discussed.

Riassunto – Il genere *Periclimenes* Costa, 1844 nel mar Mediterraneo e nell'Atlantico Nordorientale: revisione delle specie e descrizione di *Periclimenes sagittifer aegylios* subsp. nov. (Crustacea, Decapoda, Caridea, Pontoniinae).

Il genere *Periclimenes* presenta una sistematica complessa e poco conosciuta. Ricerche effettuate dagli autori hanno messo in luce la confusione dovuta a descrizioni carenti dei tipi effettuate talvolta su esemplari singoli e incompleti. Viene perciò proposta una chiave sistematica e viene descritta una nuova subspecie. Inoltre si accenna al valore sistematico delle caratteristiche cromatiche nei taxa esaminati.

Key words: Decapoda, *Periclimenes*, Mediterranean sea, Systematic.

Introduction

In a recent faunistical note on the decapod crustaceans of the Toscan archipelago (Grippa, 1991), the first named author recorded some shrimps of the genus *Periclimenes* Costa, 1844. Using the well known monograph of Zariquiey Alvarez (1968), he identified shallow-water specimens found on the sea anemone *Anemonia viridis* (Forsk., 1775) as *P. amethysteus* (Risso, 1827) and some others, living deeper and associated with bryozoans as *P. sagittifer* (Norman, 1861).

(*) Via Londonio 1, 20154 Milano - I.

(**) Avenue du Bois des Collines 34, 1420 Braine L'Alleud - B.

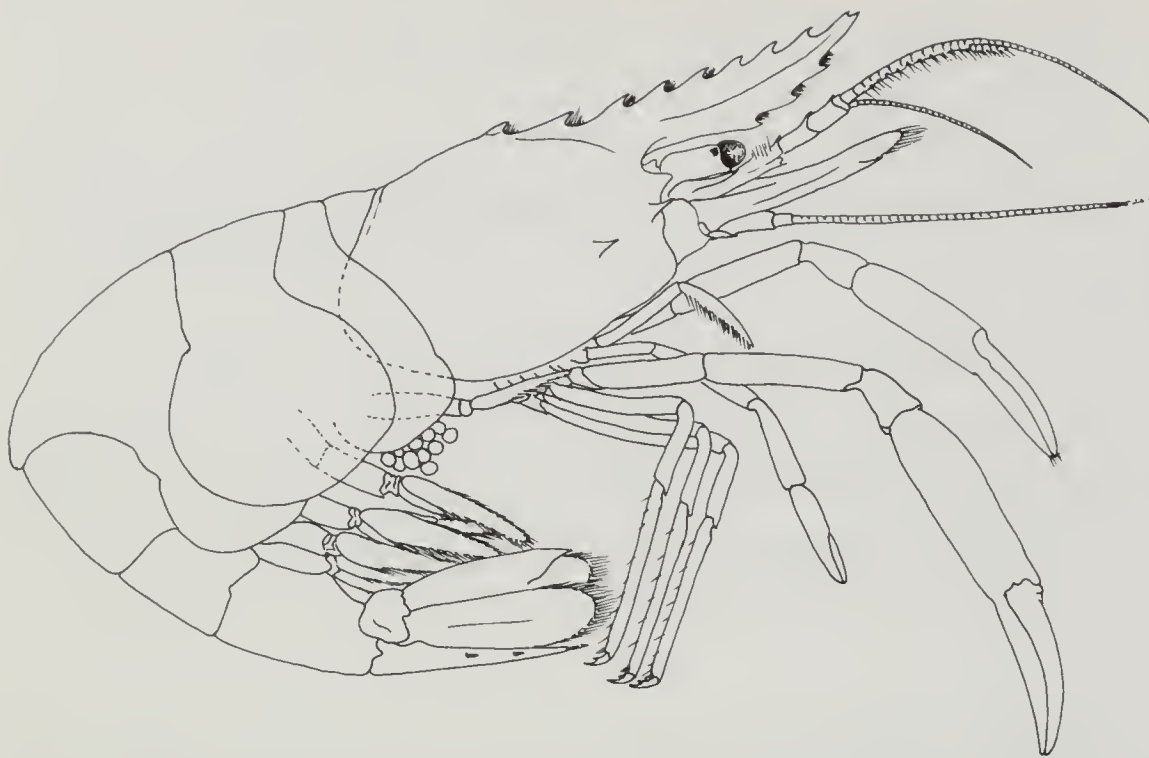


Fig 1 – *Periclimenes sagittifer aegylios* subsp. nov., holotype, ovigerous female, Giglio island.

The second named author has examined a large series of littoral *Periclimenes* from the Southwestern Channel and from the Bay of Biscay. They belonged to one unique species and they displayed a colour pattern quite distinct from that of all the *Periclimenes* reported from the Mediterranean Sea. Since *P. sagittifer* was originally described on basis of a specimen from the Channel Islands (Norman, 1861) and since there is no evidence that there is more than one shallow-water *Periclimenes* species in North West Europe, he concludes that they were true *P. sagittifer* and that the Mediterranean specimens reported under this name were probably incorrectly identified (d'Udekem d'Acoz, 1992).

After discussing together of their separate observations, the two authors decided to undertake more accurate investigations on the Mediterranean and Eastern Atlantic species of the genus *Periclimenes*. This lead them to describe a new Mediterranean form, morphologically very similar to *P. sagittifer*, but with a quite distinct colour pattern.

Review of the species

Zariquiey Alvarez (1968) lists four species of *Periclimenes* for the Iberian Peninsula: *P. scriptus* (Risso, 1822), *P. amethysteus* (Risso, 1827), *P. sagittifer* (Norman, 1861) and *P. granulatus* Holthuis, 1950. Two additional species have been reported in the Mediterranean Sea and the Northeastern Atlantic Ocean: *P. calmani* Tattersall, 1921, an Indo-Pacific species that has reached the eastern Mediterranean Sea (Port Said) through the Suez Canal (Fox, 1927; Gurney, 1927) and *P. korni* (Lo Bianco, 1903), a very rare abyssal species, originally described on specimens found in Tirrenian sea, which has been reported in the Western Mediterranean (d'Udekem d'Acoz, in press), near to the Straits of Gibraltar (de Saint-Laurent & Garcia Raso, 1993) and in the Bay of Biscay (Kemp, 1910).

Periclimenes calmani, *P. korni* and *P. granulatus* are rare, quite different from the other species and their identification does not present any problem for the time being. Good descriptions and drawings of these species in: Bruce (1987a; 1987b) for *P. calmani*, de Saint Laurent & Garcia Raso (1993) and d'Udekem d'Acoz (in press) for *P. korni*, and Holthuis (1950), Zariquiey Alvarez (1968) and Lagardère (1971) for *P. granulatus*.

The remaining species constitute a group of closely related and insufficiently known forms that we have considered here as «group *amethysteus*». The purpose of the present paper is to clarify the most serious problems in the taxonomy of this group.

***Periclimenes scriptus* (Risso, 1822) (plate 1 d)**

Alpheus scriptus Risso, 1822, p. 247; Risso, 1827, p. 78;

Periclimenes scriptus Zariquiey Alvarez, 1946, p. 85, fig. 110; Zariquiey Alvarez, 1968, p. 180, fig. 3a, 76a-d; Lagardère, 1971, p. 71, fig. 119-122; Debelius, 1982, p. 425, colour photograph; Debelius, 1983, p. 91, colour photograph (German edition only); Grippa, 1991, p. 344; Noël, 1992, p. 62; Grippa, 1993, p. 228.

Diagnosis - Body slender. Rostrum very narrow: 5.0-6.8 longer than high (including teeth). Second pereopods equal with an elongated carpus, 3-4 times longer than broad. Walking legs very slender.

Colour pattern - Transparent with red dots scattered on the whole body and appendages. A little red V-shaped drawing pointing backwards on the third pleonite. Sometimes two poorly defined dorsal red marks on second pleonite. Outer antennular flagella transparent with red and white dots.

Distribution and ecology - *P. scriptus* is distributed all over the Mediterranean Sea where it is probably the most common species both on *Posidonia* meadows and on coralligenous bottoms (Grippa, 1991; Grippa 1993). Although the second author found a juvenile of this species at 0.5-1 m depth in Southern Peloponnese, it is rarely observed in very shallow water. Besides the Mediterranean sea, it has also been reported in the tropical Eastern Atlantic Ocean by Holthuis (1951, 1952a) but this material which has been reexamined by the second author proved to be incorrectly identified. However the poor condition and the lack of information on the colour pattern of these specimens prevent making any assumption as to their definitive identity.

***Periclimenes amethysteus* (Risso, 1827) (fig. 2 d. plate 1 a)**

Alpheus amethysteus Risso, 1827, p. 77, pl. 4, fig. 16;

Periclimenes insignis O. G. Costa, 1844, p. 291; O. G. Costa, 1846, p. 1, pl. VI, fig. 1-6;

Periclimenes elegans Gourret, 1888, non Paulson, 1875;

Pelias scripta Heller, 1862, p. 406, pl. 2, fig. 34;

Anchistia scripta Heller, 1863, p. 256, pl. 8, fig. 18-19; Gourret, 1888 p. 37, p. 173, pl. XV, fig. 5-17;

Periclimenes amethysteus Pesta, 1918, p. 126, fig. 42; Zariquiey Alvarez,

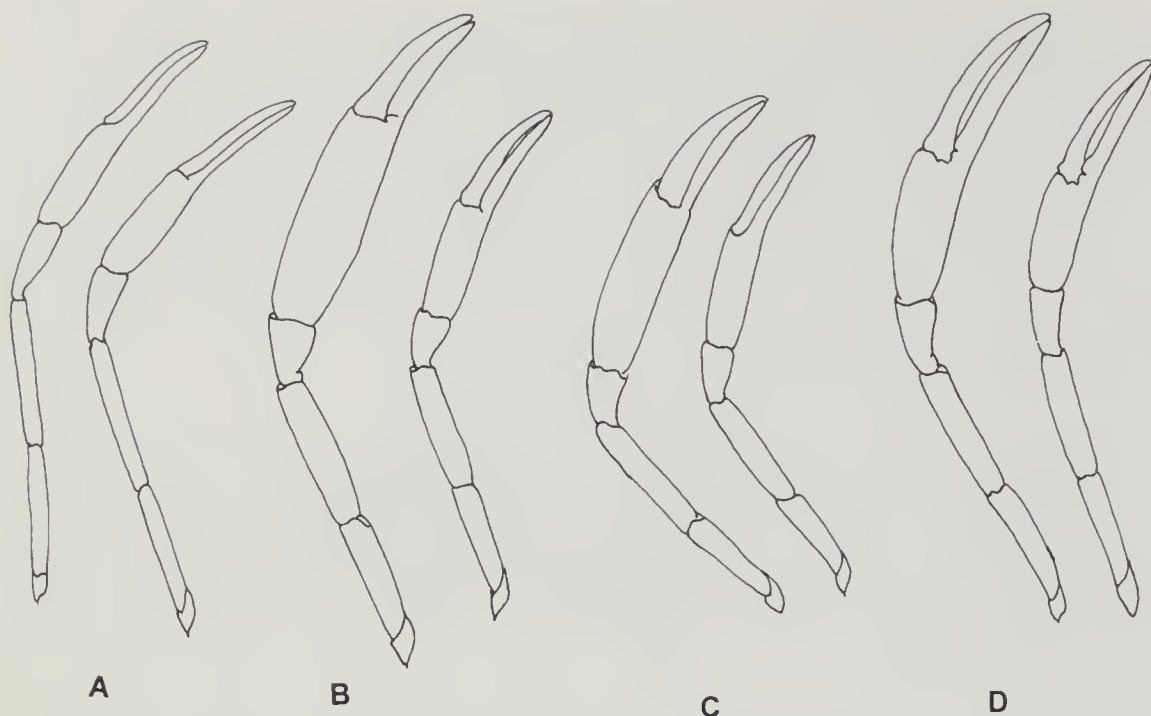


Fig. 2 – Large and small second pereopods: a) *P. scriptus* (Risso, 1822) female; b) *P. sagittifer aegylios* subsp. nov. paratype, female; c) *P. sagittifer sagittifer* (Norman, 1861), female; d.) *P. amethysteus* (Risso, 1827), female.

1946, p. 85, fig. 108-109; Holthuis, 1952b, p. 8, p. 32, fig. 4a-f; Holthuis, 1961, p. 21; Zariquey Alvarez, 1968, p. 180, fig. 2d, 75f and 76e; Lagardère, 1971, p. 71, fig. 123-125; George & George, 1980, p. 82, pl. 67, fig. 8 (colour photograph); Debelius, 1982, p. 426, colour photographs; Debelius, 1983, p. 92, colour photograph; Birkholz, 1989, p. 432 (colour photographs as *P. amethysteus* and as *P. scriptus*); Noël, 1992, p. 62; Weinberg, 1993, p. 282 (colour photograph); Baensch & Debelius, 1992, p. 257 (colour photograph); Holthuis, 1993, p. 164, fig. 155.

Diagnosis - Body robust. Rostrum high: 3.3-4.2 times longer than high (up to 4.6 in males). P2 distinctly unequal with a short carpus normally less than 2 times longer than broad but sometimes up to 2.5 times longer than broad in males. Fingers of the large second pereopod slightly longer than the palm and fingers of the small second pereopod much longer than the palm. P3-5 rather robust.

Colour pattern - A large triangular coloured mark on the posterior half of the carapace. It points forward and reaches the basis of the rostrum. Another smaller mark on the hepatic area. Seldom two small dorsal marks on the first pleonite. An elongated transverse mark on the dorsal part of the second pleonite and a round or heart-shaped mark, rarely a V-shaped mark, on the dorsal part of the third pleonite. A smaller round mark is also often present on the dorsal part of the fourth, fifth and sixth pleonites. A roundshaped mark on the 4 first pleurae of the pleonites of the mature females. All these marks are of a yellowish colour with pink or pinkish-brow-

nish red dots inside it and their border lines are white. Seen from some distance, the marks appear as pink or reddish. There are never any coloured dots on the carapace outside of these large marks. Outer edge of the exuropod white. Outer antennular flagella white. Periopods white with lilac, pink and sometimes blue transverse stripes.

Distribution and ecology - *P. amethysteus* is common in all the Western Mediterranean Sea (personal observations of both authors), occurs also in the Adriatic Sea (Holthuis, 1961) and extends into the Aegean Sea since the second author found a specimen of this species in the Northeastern part of the Bay of Souda in Crete. It has been observed between 1 and 10 m depth, usually in *Posidonia* meadows (Noël, 1983) and it is associated to the sea anemones *Anemonia viridis* (Forsk.) and *Aiptasia mutabilis* (Gravenhorst, 1831).

Periclimenes sagittifer sagittifer (Norman, 1861) (fig. 2 c. plate 1 c)

Dennisia sagittifera Norman, 1861, p. 278, pl. 13, fig. 8-13;

Periclimenes sagittifer? Neves, 1975, p. 17, fig. 6.

Diagnosis - Body and walking legs quite robust. Rostrum very high: 2.8-3.4 times longer than high. Second pereopods distinctly unequal with a short carpus, less than 2 times longer than broad. Fingers of the large second pereopod shorter than palm.

Colour pattern - Red or blue dots scattered on the whole carapace. Posterior part of carapace with a more or less well defined transverse stripe with a white border line; this stripe may be pink or colourless. Second pleonite with a pink dorsal elongated transverse mark (sometimes lacking in juveniles); the border line of the mark is also white, otherwise its colour is almost uniform (without well defined dots); this mark often presents a median constriction which gives it the appearance of two fused spots. Third pleonite with a pink dorsal V-shaped drawing pointing backwards; the inner and outer border lines of the «V» are white, otherwise the colour of the «V» is almost uniform. Outside of its white border lines, on the inner and outer parts of its tip, the V-shaped drawing has often a blackish blue mark. There is never any dorsal mark on the three posterior pleonites. The pleurae of the four first pleonites displays an uniform mauve round-shaped mark in mature females. These marks have two concentric border lines: an inner whitecoloured and an outer blackish blue. Outer antennular flagella white or transparent with white and blue or red dots. Exuropods with blue and white dots; its outer edge is sometimes white. The second pereopods shows a pattern made of blue and often white dots that may be scattered or aggregated to make more or less well defined transverse stripes. The Pr3-4-5 show rather well defined blue transverse stripes.

Distribution and ecology - *P. sagittifer sagittifer* is an Atlantic form originally described from Jersey, Western Channel (Norman, 1861). Although its holotype cannot be located in the British Museum (P. F. Clark, in litt.) and must therefore be considered as lost, the identity of the species presents no problem since it seems that only one shallow-water *Periclimenes* li-

ves in the Channel. It has been found in the South West Channel (exceptionnaly Eastern Channel) and the Bay of Biscay (Norman, 1861; 1907; Sollaud, 1960; Bourdon, 1965; d'Udekem d'Acoz, 1992) and it extends southwards at least as far as Algeciras Bay, Straits of Gibraltar (photographs of one specimen kindly sent by J. I. Gonzalez-Gordillo). There is also a somewhat dubious record from Portugal: Neves (1975). The illustration of the carapace given by this author fits well with *P. sagittifer sagittifer* but it is not the case for her description of the second pereopods. *P. sagittifer* has been found on lower shore and in shallow waters and is associated with the sea anemone *Anemonia viridis* (Forsk.) This association appears to be parasitism since the second author observed that it eats the tips of the tentacles of its host in aquarium.

***Periclimenes sagittifer aegylios* subsp. nov.** (fig. 1, fig. 2 b, plate 1 b)

P. sagittifer George & George, 1980, p. 83, pl. 68 fig. 2 (colour photograph); Debelius, 1982, p. 426 (colour photographs); Debelius, 1983, p. 92 (colour photograph);

P. amethysteus Fiala-Mèdioni et al., 1987, p. 118, fig 96 (colour photograph); Grippa, 1991, p. 345; Baensch & Debelius, 1992, p. 527 (colour photograph); Grippa, 1993, p. 228;

not *P. sagittifer* Zariquiey Alvarez, 1968, p. 179, 181; Grippa, 1991, p. 344; Grippa 1993, p. 228.

Holotype: 1 ovigerous female, carapace length 11 mm, total length 32 mm. Paratype: 1 female, carapace length 11 mm, total length 35 mm.

Western Italy, Giglio Island, Punta della Secca, 42°21'N - 10°54'E, about 10 m deep, associated with *Anemonia viridis*, 3/V/1986, collected by M. Alvisi and deposited in the Museo Civico di Storia Naturale di Milano, registration numbers MSNM Cr 2425 and MSNM Cr 2426.

Other samples examined: about 60 specimens, Bay of Naples, Western Italy, collection E. Sollaud, Museum National d'Histoire Naturelle, Paris. Colour alive unknown; 2 specimens, La Ciotat, mediterranean coast of France, about 1.5 m deep, associated with the sea anemone *Condylactis aurantiaca*, 24/X/1992, collected and photographed by Marco Faasse and provisionally in the collection of C. d'Udekem d'Acoz; 3 specimens, Croatia, Rovinj, 1971: 1 male and 1 female collected and photographed by A. Svoboda, Nationaal Natuurhistorisch Museum, Leiden, Reg. nr. 28570; 1969: 1 female on *Condylactis aurantiaca*, Reg. nr. 25933; 1 specimen, Croatia, Krk, 1969: female collected by A. Svoboda on *Condylactis aurantiaca*, Nationaal Natuurhistorisch Museum, Leiden, Reg. nr. 25932.

Etymology: from greek αἴγρος = goat, toponym, original name of the type-locality.

Description - Outline robust. Rostrum high: 2.4-4.2 and usually 3.0-3.5 times longer than high, normally straight but occasionally slightly convex or curving upwards. 8-9 dorsal teeth, 2 (sometimes 3) being in postrostral position, the first one approximately on the middle of the carapace. 3-4 ventral teeth.

The eyestalks, extended forward, do not reach the middle of the ro-

strum. Eyestalks with an accessory pigment spot. Besides the stylocerite, the first joint of the antennular peduncle presents a sharp subdistal outer spine. Undivided part of the outer antennular flagellum 2.5-3 times longer than the free part of its small branch. Scaphocerite about 2.5 times longer than broad, extending beyond the rostrum; its scale exceeds its outer distal spine. Mandible without palp, with molar and incisive process (the latter with 3 teeth).

First pereopods short and symmetrical with carpus nearly as long as propodus and with fingers about equal to palm. second pereopod distinctly unequal. Large second pereopod with fingers shorter than palm and with carpus about 1.5 times longer than broad. Pr3-4-5 usually strong; their propodus is 9-15.5 times longer than broad; their dactylus are bifid and are often very robust.

Pleurae of the pleonites round. Posterior part of the tergite of the third pleonite protruding behind. Dorsal length of the sixth pleonite 1.4-1.5 times longer than its maximal height. Telson with two pairs of dorsolateral spines on its distal half; its apex is triangular and bears 3 pairs of spines with the following length relationship: outer spines < central spines < intermediate spines.

Colour pattern - Body transparent. Carapace with red or blue dots



Plate 1 – Colour pattern of the European species and subspecies of *Periclimenes* of the group *amethysteus*: a) *Periclimenes amethysteus* (Risso, 1827), ovigerous female, Crete, NW of the bay of Souda (photo C. d'Udekem d'Acoz); b) *Periclimenes sagittifer aegylios* subsp. nov., ovigerous female, Giglio Island (photo M. Alvisi); c) *Periclimenes sagittifer sagittifer* (Norman, 1861), ovigerous female, Chausey Islands (photo C. d'Udekem d'Acoz); d) *Periclimenes scriptus* (Risso, 1822), ovigerous female, Banyuls (photo J. Lecomte).

scattered over its whole surface and with a transverse stripe on its posterior part; this stripe is lilac or colourless with white border lines. A very large V-shaped mark pointing backwards extends on the second and third pleonites. Each branch of the «V» presents a constriction at the junction of the second and the third pleonites. The «V» is uniform lilac with white border lines. Outside of its white border lines, on the inner and outer parts of its tip, the V-shaped drawing has a small blue mark. There are no dorsal marks on the three posterior pleonites. The pleurae of the four first pleonites display uniform mauve round-shaped marks in mature females. These marks have two concentric borders: an inner white-coloured and an outer blackish blue. Exuropods with a white outer edge and blue spots at the apex. Tip of scaphocerites blue-spotted. Outer antennular flagella white. First and second pereopods white with lilac, pink and blue transverse stripes. Pr 3-4-5 white with blue transverse stripes.

Distribution and ecology - *P. sagittifer aegylios* has been recorded from Giglio and Montecristo Islands (Northwestern Italy), Naples, Tremiti Islands and Croatia (Adriatic sea), La Ciotat (Mediterranean coast of France). Debelius (1983) records it also (as *P. sagittifer*) from Ibiza, Balearic Islands and from unspecified localities in Spain and Greece. It has been found associated with the sea anemone *Anemonia viridis* (Forsk.) by the first author and *Condylactis aurantiaca* (Delle Chiaje) by M. Faasse and A. Svoboda. This last association may be occasional.

Discussion

Contrary to many other caridean shrimps, in the genus *Periclimenes*, the chromatic characteristics show little individual variations (Noël, 1983) and therefore they have good systematic value. There are only some small changes correlated with age and sexual maturity, while there are no important adaptative variations related to habitat or to host. However, Noël (1983) points out that the colour patterns show important nyctemeral fluctuations, the chromatophores contracting in darkness and spreading out under light.

Therefore it is highly probable that the many confusions between *P. amethysteus*, *P. sagittifer aegylios*, *P. sagittifer sagittifer* and sometimes *P. scriptus* can be essentially attributed to their examination as preserved samples whose colours have been consequently lost. As previously indicated, there are slight but significant morphological differences between *P. amethysteus* and *P. sagittifer aegylios*, while the main difference between the *P. sagittifer aegylios* and *P. sagittifer sagittifer* is their colour pattern. The exact systematic relationship between the two forms of *P. sagittifer* is difficult to establish for the time being and therefore we prefer to consider them here as subspecies. However the available data suggest that they are allopatric, the typical form being Atlantic while the form *aegylios* seems to be endemic to the Mediterranean Sea.

It is also important to point out that the description of the *P. sagittifer* by Zariquiey Alvarez (1968) does not fit at all with *P. sagittifer aegylios* nor *P. sagittifer sagittifer*, particularly as concerns the second pereopods. It is today impossible to establish which species Zariquiey had in his hands at

the time, but his incorrect description has been the cause of many confusions between *P. sagittifer sagittifer*, *P. sagittifer aegylios* and *P. amethysteus* with the consequence that many records of the literature are unreliable.

Finally it is necessary to note that the Mediterranean form identified as *P. sagittifer* by Grippa (1991) is neither *P. sagittifer aegylios* nor *P. amethysteus*. Its complete identity remains unsettled: it is morphologically very similar to *P. scriptus* while its coloured dots are blue and not red as in the latter.

Key to the Mediterranean and northeastern Atlantic periclimenes

- 1 - Dactylus of P3-5 mononguiculate 2
 - Dactylus of P3-5 biunguiculate 3
- 2 - Accessory branch of outer antennular flagellum much shorter than fused portion, with only 2 segments. Eyestalk with ocellus. External distal spine of antennal basal article quite long. Fifth abdominal pleurae acute *P. calmani* Tattersall, 1921
 - Accessory branch of outer antennular flagellum slightly longer than fused portion, with about 9 segments. Eyestalk without ocellus. External distal spine of the basal antennal article small. Fifth abdominal pleurae round *P. korni* (Lo Bianco, 1903)
- 3 - First dorsal tooth approximately on anterior fourth of carapace and widely distant from the second; rostrum with 7-11 dorsal and 4-5 ventral teeth. Eyestalk without ocellus. Pr2 granulated with one tooth on cutting edge of fixed finger and two on cutting edge of dactylus. The last four pleonites may be granulated. Apex of telson round-shaped and with about 11 spines. Pale pink with some red dots. *P. granulatus* Holthuis, 1950
 - First dorsal tooth approximately on the middle of pereon and close to the second; rostrum with 6-9 dorsal teeth and 2-4 ventral teeth. Eyestalk with ocellus. Pr2 not granulated and without teeth on the cutting edge of their fingers. Last four pleonites never granulated. Apex of telson triangular and with 6 spines 4
- 4 - Pr2 similar in size and slender, with carpus 3-4 times longer than broad and with narrow fingers. Pr3-4-5 slender. Rostrum narrow: 5.0-6.8 times longer than high (rostrums in regeneration may be higher). Dorsal length of sixth pleonite about 2.0 time longer than its height in adults. Colour pattern made of red dots scattered on the whole body and appendages *P. scriptus* (Risso, 1822)
 - Pr2 distinctly unequal and robust, with carpus normally less than 2 times longer than broad (but sometimes up to 2.5 times longer than broad in male *P. amethysteus*) and with high fingers. Pr3-4-5 robust or very robust. Rostrum high: only 2.8-4.2 (4.6) times longer than high (including teeth). Dorsal length of sixth pleonite 1.4-1.6 time longer than its height in adults 5
- 5 - Dactylus of large Pr2 longer than palm. No isolated dots on the carapace but the dorsal marks of carapace and pleon are themselves dotted. All pleonites may have dorsal marks *P. amethysteus* (Risso, 1827)
 - Dactylus of the large Pr2 shorter than palm. Many isolated red or blue dots on carapace but no distinct dots on the dorsal mark(s) of the pleon. Dorsal mark(s) on third and second pleonites but never on the three last pleonites 6

- 6 - A short dorsal V-shaped drawing limited to the third pleonite. Second pleonite with an elongated transverse dorsal mark (sometimes lacking in young specimens). Pr2 with blue and white dots forming sometimes poorly defined transverse stripes. Eastern Atlantic *P. sagittifer sagittifer* (Norman, 1861)
- A large dorsal V-shaped drawing running through the second and third pleonite. Pr2 white with well defined transverse stripes and spots of blue, lilac and pink colour. Mediterranean *P. sagittifer aegylios* subsp. nov.

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